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10/082,227	02/26/2002	Hisae Yoshizawa	112046	2635

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EXAMINER

LISH, PETER J

ART UNIT PAPER NUMBER

1754

DATE MAILED: 06/23/2003

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Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/082,227

Applicant(s)

YOSHIZAWA ET AL.

Examiner

Peter J Lish

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 03/21/02.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-25 is/are pending in the application.
- 4a) Of the above claim(s) 1-15, 24 and 25 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 16-23 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☒ Claim(s) 1-25 are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 3.
- 4) ☒ Interview Summary (PTO-413) Paper No(s) 6.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

**DETAILED ACTION**

***Election/Restrictions***

Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-13, 15, and 25, drawn to a nanowire, classified in class 423, subclass 447.1.
- II. Claims 16-23, drawn to a method of producing a nanowire, classified in class 264, subclass 29.2.
- III. Claim 14, drawn to a nanonetwork, classified in class 252, subclass 62.3e.
- IV. Claim 24, drawn to a method of producing a nanonetwork, classified in class 438, subclass 99.

The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the product can be made by another and materially different process, such as the growth of multiwalled nanotubes using chemical vapor deposition.

Inventions I and III are related as subcombinations disclosed as usable together in a single combination. The subcombinations are distinct from each other if they are shown to be separately usable. In the instant case, invention I has separate utility such as for the reinforcement of a polymer fiber. See MPEP § 806.05(d).

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Inventions I and IV are at best related as product and process of use. The inventions can be shown to be distinct if either or both of the following can be shown: (1) the process for using the product as claimed can be practiced with another materially different product or (2) the product as claimed can be used in a materially different process of using that product (MPEP § 806.05(h)). In the instant case the product can be used in a materially different process, such as for the reinforcement of a polymer fiber.

Inventions II and III are unrelated. The inventions are distinct for a combination of the reasons given above. The product of Group I can be made by another and materially different process and the product of Group I has separate utility from that of Group III.

Inventions II and IV are unrelated. The inventions are distinct for a combination of the reasons given above. The product of Group I can be made by another and materially different process and the product of Group I may be used in a materially different process.

Inventions III and IV are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the product can be made by another and materially different process, such as the chemical attachment of the nanowires to a patterned substrate.

During a telephone conversation with Jim Voeller on 27 May 2003, a provisional election was made with traverse to prosecute the invention of Group II, claims 16-23. Affirmation of this election must be made by applicant in replying to this Office action. Claims 1-15 and 24-25 are

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withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 16, 20-21, and 23 are rejected under 35 U.S.C. 102(b) as being anticipated by Ago et al. ("Work Functions and Surface Functional Groups of Multiwall Carbon Nanotubes").

Ago teaches various methods for the oxidation of multi-walled carbon nanotubes. The result of this oxidation treatment is a structure consisting of an inner core portion of unreacted layers and an outer functional portion of oxidized layers, see Figure 4. The outer graphene sheets, which are modified by oxidation, inherently contain defects in the graphite structure that produce areas of amorphous, or non-graphitic, carbon. The functional layer has at least two layers of modified graphene sheets. No difference is seen between the method of Ago et al. and that of the instantly claimed invention.

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Claims 16-23 are rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Niu et al. (US 2003/0039604 A1).

Niu et al. teach a process of dispersing multi-walled carbon nanotubes which comprises dispersing nanotubes in a solvent at high shear in a high-shear mixer (paragraph 0121). It also teaches that an improved dispersion is obtained if the high shear procedure is followed by ultrasonication (paragraph 0122). It is not specifically taught that the process results in a structure consisting of a core portion having at least one layer of the nanotube graphene sheets and a functional layer having modified graphene sheets. However, it is expected that this structure will result from the dispersal because no difference is seen between the process of Niu et al. and that of the instantly claimed invention.

The outer graphene sheets, which are modified by mechanochemical treatment, inherently contain defects in the graphite structure that yield areas of amorphous, or non-graphitic, carbon.

Regarding claims 19 and 23, Niu et al. does not explicitly teach that the dispersal treatment results in a functional layer consisting of two or more modified graphene sheets. Nor does it teach that the treatment results in node portions separating the core portion of the nanotube in a longitudinal direction. It is expected that at least a portion of the nanotubes modified by the treatment of Niu et al. contain these structures, however, as no difference is seen between the process of Niu et al. and that of the instantly claimed invention.

Niu et al. also teach a process wherein the multi-walled carbon nanotubes are surface oxidized by chemical reaction with peroxygen compound containing compositions. It is expected that the result of this oxidation treatment is a structure consisting of an inner core

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portion of unreacted layers and an outer functional portion of an oxidized layer or oxidized layers, as is known in the art to occur when an oxidizing agent contacts the surface of the nanotube. The outer graphene sheet(s), which are modified by oxidation, inherently contain defects in the graphite structure that yield areas of amorphous, or non-graphitic, carbon.

Regarding claim 22, Niu et al. teaches that the oxidized carbon nanotubes can be subjected to secondary treatment such as the linking of the surface modified nanotubes to form a network. The nanotubes are linked to each other, or adhere to each other, through the modified, or amorphous, areas.

Claims 16-21 and 23 are rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Zhou (US 2002/0193040 A1).

Zhou teaches a process for the purification and processing of multi-walled carbon nanotubes wherein the nanotubes are kept in suspension in an acidic medium for several hours using a high-powered ultrasonic horn (paragraph 0043). The nanotubes are then processed by ball milling. The time that the sample is milled can vary; an appropriate amount of milling time can be readily determined by inspection of the milled nanotubes (paragraph 0045).

It is not specifically taught that the process results in a structure consisting of a core portion having at least one layer of the nanotube graphene sheets and a functional layer having modified graphene sheets. However, it is expected that this structure will result from the treatment because no difference is seen between the process of Zhou and that of the instantly claimed invention.

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The outer graphene sheets, which are modified by mechanochemical treatment, inherently contain defects in the graphite structure that yield areas of amorphous, or non-graphitic, carbon.

Regarding claims 19 and 23, Zhou does not explicitly teach that the dispersal treatment results in a functional layer consisting of two or more modified graphene sheets. Nor does it teach that the treatment results in node portions separating the core portion of the nanotube in a longitudinal direction. It is expected that at least a portion of the nanotubes modified by the treatment of Zhou contain these structures, however, as no difference is seen between the process of Zhou and that of the instantly claimed invention.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 19 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Niu et al.

Niu et al. is applied above. Niu et al. do not explicitly teach that either treatment results in a functional layer consisting of two or more modified graphene sheets. Nor does it teach that either treatment results in node portions separating the core portion of the nanotube in a longitudinal direction.



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Niu et al. does teach, however, that the application of high shear mixing may take up to several hours. It would have been obvious to one of ordinary skill at the time of invention to perform the dispersal process of Niu et al. for a time that is sufficient to yield the claimed structures, in order to achieve high-quality dispersal of the nanotubes.

Niu et al. also teaches a wide range of oxidizing agents, temperatures, pressures, and contact times for the surface oxidation treatment. It would have been obvious to one of ordinary skill at the time of invention to perform the oxidation process of Niu et al. under conditions sufficient to yield the claimed structures, in order to achieve high-quality surface modification.

Claims 19 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhou.

Zhou is applied above. Zhou does not explicitly teach that the process results in a functional layer consisting of two or more modified graphene sheets. Nor does it teach that the process results in node portions separating the core portion of the nanotube in a longitudinal direction.

Zhou does teach, however, that the ball milling process time can be varied based on inspection of the milled nanotubes. It would have been obvious to one of ordinary skill at the time of invention to perform the dispersal process of Niu et al. for a time that is sufficient to yield the claimed structures, in order to achieve high-quality shortening of the nanotubes.

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***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Peter J Lish whose telephone number is 703-308-1772. The examiner can normally be reached on 9:00-6:00 Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley Silverman can be reached on 703-308-3837. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-305-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.



PL  
June 5, 2003

**STUART L. HENDRICKSON**  
**PRIMARY EXAMINER**